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ADJUSTING THE LENS – QUALITY MANAGEMENT IN V4 COUNTRIES THROUGH TIMES OF CRISES

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Purpose: The idea of the study is to understand fluctuation in quality management depending on organizational context. The primary purpose of this article is to analyze changes in quality management in four countries grouped in V4 (The Visegrad Group) in the prism of macroeconomic crises, over the last five years. The following research question was formulated: What influences market saturation with a formal approach to quality management (ISO 9001 certificates), and when?
Design/methodology/approach: The considerations are based on a systematic literature review (SLR) and an analysis of the long-term data of ISO survey – certifications. The data was compared among V4 countries and an attempt was made to relate the results to economy-wide indicators, especially in turbulent environments.
Findings: The results show no clear and unidirectional relationships between the number of ISO 9001 certifications and macroeconomic data. This was identified for the V4 group as a whole and for individual countries, as well. Implementation of the QMS is an individual decision of each organization, depending on closely related microeconomic factors.
Research limitations/implications: Research findings always represent a slice of a larger reality. In that research paper limitations concern: the period of analysis, literature review in English and supplemented locally in the native languages, focusing on the V4 area. Findings implicate quality management's perceptions need to adjust the lens to understand macro numbers of certificates by the circumstances and adjust micro decisions in organizations in the QM area depending on the crisis phase on the market.

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Originality/value: The article analyses certification data in previously unpresented form. Results were compared between V4 countries in the prism of times of crisis with an indication of certificate saturation rates and an attempt to explain macroeconomic fluctuations. The research results are helpful for researchers exploring quality management issues, and all organizations that can relativize the importance of quality management.
Keywords: quality, quality management, V4 countries, crisis management.
Category of the paper: research paper.

1. Introduction – connecting the dots

The quality of products (commodities and services) is the basis for the functioning of any organization in the market. Adequate quality (tailored to customers) is the result of repeatable processes as a result of effective process ownership and the role of employees, notably process owners (Danilova, 2019), which cannot be overestimated. Quality Management has become a mainstream managerial approach for improving products, services, and business processes in order to generate superior customer satisfaction and pursue competitive advantage (Dahlgaard-Park et al., 2018). Product Quality in the field of business has been explored from different perspectives and Rosillo-díaz et al. (2022) indicated (after a bibliometric analysis of 3484 documents published between 1989-2019) the timeliness of this topic over the years. It can be noted that price has become a sign of basic quality, that is, a variable essential in determining a product's perceived quality (Rosillo-díaz et al., 2022). Of course, individually, the price-quality relationship is not always directly proportional, which is connected with different business practices (and marketing strategies) of individual organizations. The same is true of having an "ISO 9001 certificate", an organization that has implemented a Quality Management System (QMS) does not necessarily carry out its processes in a repetitive manner and thus the products resulting from them are not always of adequate quality. Although all consumer categories perceive products, services, and organizations certified to international management system standards favourably, the inclination towards certification is greater among developing economies than in developed economies (Yadav et al., 2022). In general, there is a positive relationship between quality management system (QMS) certification and employee- and customer-related company performance (Milovanović et al., 2023). But the cause-effect relation is not so obvious, in individual cases. Dick et al. (2008) concluded that quality management system certification has an influence on business performance but also there is an opposite relationship – whereby better-performing firms self-select to adopt ISO 9001 certification. What on the micro-scale can be considered in individual circumstances takes on a more general shape on the macro scale. Carnerud & Bäckström (2019) identified and depicted the key areas around which quality research has orbited during the past 37 years. They identified seven central topics around which quality research has centred during this period: Service

Quality & Customer Satisfaction; Process Design & Control; ISO Certification & Standards; TQM – Implementation, Performance & Culture; QM – Practices & Performance; Reliability, Costs, Failure & Problems and Excellence – BEMs, Quality Awards & Excellence in Higher Education (Carnerud, Bäckström, 2019). Research on quality is still vibrant and relevant but thematic concentration is variable and dependent on the external conditions of a particular organization, at a given time.

Time and space influence the economic conditions in individual organizations. Repeatable processes are disrupted from both internal sources (the organization – its resources, including employees) and external sources (the near and far environment). Control systems are used by organizations to detect internal and external changes in order to gain business goals but they may not be sufficient in turbulent environment, thus there is a need to develop capabilities to be responsive to disruptions (Madani, Parast, 2023). It means to enhance organizational resilience which is defined as the "ability of an organization to absorb and adapt in a changing environment" (ISO 22316, 2017, point 3.4, p. 1). The main purpose of organizational resilience is to boost effective reactions against crises with the view to assure business continuity during disruptions. The understanding of crisis management is diverse in the literature and depends on the characteristics of the organization (Khodarahmi, 2009). Organizational crisis (a crisis that affects the organization, regardless of the source) is described as "a disruptive, unstable event that requires decisions to be made quickly to avert the threat to survival" (Andres, Heo, 2023). The CRISIS framework guides crisis management in six steps: Coping, Rethinking, Initiating, Sensing, Intervening, and Sandbagging (Chong, 2004). But this is the sequence of actions in the crisis phase, activities grouped in a reaction set. In business, it is important to take preventive measures and anticipate and prevent crises, including learning from previous ones. This means that crisis management consists of actions taken in three phases according to the most common Smith's model (Bhaduri, 2019): pre-crisis, crisis response, and post-crisis. One possible way to take preventive action is to use the "Risk-based thinking" that is promoted in ISO 9001 standard. "Risk-based thinking enables an organization to determine the factors that could cause its processes and its quality management system to deviate from the planned results, to put in place preventive controls to minimize negative effects and to make maximum use of opportunities as they arise" (ISO 9001, 2015, p. vi).

Product quality is the basis for the organization's existence in the market. Quality management system influences the repeatability of quality and "ISO 9001 certification" influences the perception in the market. The result of operations is influenced by proper process management, within which "risk-based thinking" is taken into account. So the question arises – Can an "ISO 9001 system" strengthen organizational resilience and support an organization in crisis? Zapłata & Wiśniewski (2022) indicated in a case-study that a certified quality management system can be a tool to assure business continuity in a crisis. But there is a need to identify that relation in the macro view.

Two areas of research emerge from the above: the importance of product quality, the role of the ISO 9000 system, and the importance of QMS in a changing environment (during crisis time).

1.1. Research area – 5W: what, which way, when, where, why

In theory, certified quality management system ISO 9001 can be a tool to assure business continuity in crisis, because of the "risk-based thinking" internal mechanism. The question is – is it possible to take this observation to the macro scale? In the literature, there is no research about the number of ISO 9001 certificates depending on the crisis macroeconomic situation. There is a scientific gap and identification that relation could help in raising awareness of the role of quality management systems in business continuity.

Description of the research area contains five elements – 5W:

1. What. Analysis of fluctuation in "ISO 9001 certificates" in time of macroeconomic crisis – Covid-19 pandemic. This worldwide crisis was unprecedented and affected essentially every organization in the world. This is one of the recent macroeconomic crises so obtaining this data affects its timeliness and usefulness. Also, another crisis (war in Ukraine) affects the issues analyzed. The main goal is to find answer on question: What and when influences on market saturation with a formal approach to quality management (ISO 9001 certificates)?
2. Which way. The road to gain the goal contains three analyses. First is systematic literature review in area of "ISO 9001" to identify factors of (re)certification (mainly macro). Second is comparing literature findings with data on the number of ISO 9001 certificates. Third is national analysis (within V4 countries) comparison to macroeconomic data.
3. When. The analysis period covers 2018-2022 due to two issues. Firstly, the latest ISO 9001 was published in 2015, and as of 2018, only certificates confirming QMS compliance with this standard are valid. Secondly, Covid-19 in various locations started in late 2019/early 2020.
4. Where. The analysis covers four countries: Czech Republic, Hungary, Poland, and Slovakia. Those four countries are grouped in V4 (The Visegrad Group) because of similar economic and territorial conditions and history. Such profiling will allow macro dependencies to emerge, but with detailed analysis and the emergence of dependencies and conclusions at the national level.
5. Why. Madani and Parast (2023) analyzed subject of organizational resilience on the SLR basis at the time preceding between 2000-2018. Because of the turbulent environment, there is a need to look at that relationship in the newest time. Results will allow business improvement by addressing issues affecting business continuity in the most common "ISO 9001 system".

1.2. Research protocol and basic material

A literature review article provides an overview of literature related to some subject and there are many methods and tools to achieve the planned goal (Paul, Rialp, 2020). "Selecting the right database like Web of Science (WoS) and/or Scopus is the first step usually for developing a review article" (Paul et al., 2023). Scopus most often provides a database of literature research in the area of both "quality management" (Camango, Cândido, 2023a) (Fonseca et al., 2022) and "business continuity/organizational resilience" (Corrales-Estrada et al., 2021; Conz, Magnani, 2020; Rahman et al., 2022). The SCOPUS database was selected for this study as the most inclusive database to identify relevant studies. The identification of the literature was carried out using the term/number "9001" only in the title, because of finding articles exactly about the standard. According to the process delineated by the SLR method (Kushwah et al., 2019) in research protocol was defined, and applied strict inclusion criteria. To be included in the study, the articles had to meet five criteria: (1) published between 2018-2023, (2) studies in English, (3) in scientific journal, (4) peer-reviewed journal, (5) full-text article. A systematic literature review was adopted as the method of study, due to the thematically specific scope of the review and the relatively small number of articles, facilitating manual analysis of their content (Donthu et al., 2021, Table 1, p. 287). As a result of the above criteria, 120 articles were identified in the Scopus database (status as of November 17, 2023). After analysis, 8 articles were removed (repetitions and written in another language – only the abstract in English). 112 articles, listed in the appendix (Tables 11-16), were accepted for further analysis. These articles were published in a total of 56 topical journals, and the most common ones (without single items – 41) are presented in Table 1.

Table 1.
Journals with the majority of "ISO 9001 articles" in the sample

No.	Journal title	No. of articles
1.	Total Quality Management & Business Excellence	18
2.	The TQM Journal	12
3.	International Journal of Quality & Reliability Management	9
4.	International Journal for Quality Research	5
5.	International Journal of Productivity and Performance Management	5
6.	South African Journal of Industrial Engineering	3
7.	Sustainability	3
8.	Gestão & Produção	2
9.	IEEE Access	2
10.	International Journal of Production Economics	2
11.	International Journal of Quality and Service Sciences	2
12.	Production Engineering Archives	2
13.	Production Planning & Control	2
14.	Quality - Access to Success	2
15.	Systematic Reviews in Pharmacy	2

Source: own elaboration.

In 15 journals, articles were published more than once. In total, these articles account for more than 63% of all those analyzed. Almost 35% of the articles were published in three journals, which by their title direct the reader to quality management issues.

An analysis of articles by type shows a split between the traditional two groups – empirical and theoretical studies (shown in Table 2).

Table 2.
Breakdown of articles by type and territorial scope of empirical studies

Year	No. of articles	Research papers (Europe sample/V4)	Theory papers
2018	18	16 (8/2)	2
2019	13	11 (5/0)	2
2020	26	22 (13/4)	4
2021	22	16 (9/2)	6
2022	16	14 (5/1)	2
2023	17	15 (7/1)	2
Total:	112	94 (47/10)	18

Source: own elaboration.

Most of the articles (84%) have "Research paper" status, contain primary data from mainly surveys (Idris, Durmuşoğlu, 2023; Siougle et al., 2023) and sometimes case-studies (Cződörová, Gnap, 2023; Georgiev, Georgiev, 2023) or Delphi-method (Bastas, Liyanage, 2018; Chiarini, 2019). The 47 articles in the group of 94 empirical ones present area-based studies realized in European countries. While ten of them deal directly with the countries of the V4 group, and they were referred to in the following section. Theory papers, which contain secondary data, describe mostly literature review (Cândido, 2023; Abuazza et al., 2020) as well as proposals for different models (Ikram et al., 2021a; Marra da Silva Ribeiro et al., 2022).

2. ISO 9001 – literature review

The analysis of the collected articles focused on three issues. First, there is a general description of the topics covered in the analyzed articles. Second, the purpose of the analysis was to identify factors influencing ISO 9001 certification and abandonment of QMS maintenance. Third, on the analysis of the subject matter in the V4 countries. The elements identified in this way will then serve as criteria for a detailed analysis – systemic quality management in V4 countries through the prism of data on the number of "ISO 9001 certifications".

2.1. Literature review results – general approach

Content analysis of the 112 articles indicates that the vast majority of the articles deal with quality management at the micro level, in relation to the functioning of individual organizations. Most often, the conclusions concern the positive impact of QMS on the functioning of the

organization (Ibtissam et al., 2023; Aldabbas et al., 2020) and, consequently, on the financial results of running the business (Idris, Durmuşoğlu, 2023; Vanichchinchai, 2022; Slakey et al., 2021; Zimon et al., 2018) and even on the stock price – as a result of the publicity about obtaining "ISO 9001 certification" (Kiryanto et al., 2022). But of course, the detailed results depend on the specifics of each organization (Damic, 2022). For example QMS according to ISO 9001 is more important for stakeholders than customers – this confirms that certification is more important in the B2B market than in B2C (Neves et al., 2023). Also in the case of international functioning the adoption of ISO 9001 certification is positively associated with exports (Yang et al., 2023). In another article, the authors indicated ambivalent behavior toward the ISO 9001 standard's formal requirements (Georgiev, Georgiev, 2023). In turn, included in the latest version of the standard "risk-based thinking" was analyzed overall in QMS (Popova et al., 2019) or through am onsite management system audit (Naveen et al., 2022). Strangely enough, the seven publications in the period under review were based on research conducted several years earlier – on a sample of "old QMS ISO 9001:2008" (Georgiev, Georgiev, 2023; Nedra et al., 2022; Zayas-Mateo, Martínez-Lorente, 2021; Kebede Adem, Virdi, 2021; Castello et al., 2020; Tomic, Spasojevic Brkic, 2019; Rodríguez-Mantilla et al., 2019).

2.2. Literature review results – factors of (re/de)certification

Grounds for the decision to implement and certify a quality management system are diverse and linked to the individual goals of a given organization as has been described many times in the literature. In the group of articles analyzed, the issues of decertification from the perspective of the organization, indicate that the disappearance of the factors influencing the decision to first certify makes certification unnecessary in achieving the goals of the organization (Zimon, Dellana, 2020). Also antecedents to decertification propensity are barriers to the initial certification, (absence of) external certification benefits, decertification motivations, and expected performance after decertification (Ferreira, Cândido, 2021). Similar to the motives for implementing the system, the reasons for the withdrawal of the "ISO 9001 certificate" can be divided into external and internal. From the outside point of view decisive is the customers' lack of interest in ISO 9001 (Chiarini, 2019) and the perceived lack of added value from certification (Simon, Kafel, 2018) as well as the absence of acquisition of new contractors (Midor, Wilkowski, 2021). From the inside point of view the decision to abandon certification is related to a lack of time for improvement efforts and questionable cost-benefit relation (Zimon, Dellana, 2020) as well as internal factors, such as financial problems within the organizations (Simon, Kafel, 2018). Cândido & Ferreira (2022) noticed that the main factors influencing EPAD (expected performance after decertification) are external decertification motivations and internal certification benefits. These authors, in another article, pointed out that the internal motivations for decertification are a result of changes in the relationship over time between motivations and a firm's previous certification barriers and benefits (Cândido, Ferreira, 2023) but research on decertification motivations is still incipient (Camango, Cândido, 2023).

It can indicate the articles with statistical data about the market diffusion and trends in the number of ISO 9001 certificates worldwide, along with a prediction of their number in the future (Ikram et al., 2021). Mastrogiacomo et al., (2021), after analyzing trends over 25 years, pointed out that the number of certifications tends to stabilize. The saturation of ISO 9001 standard certification differ between countries around the world and mainly is analyzed in the prism of Gross Domestic Product (GDP) (Marra da Silva Ribeiro et al., 2022). The limited implementation of ISO 9001 certifications in some countries could be due to several internal and external factors such as the relatively low awareness level of the certification caused by low grade of internationalization and quality awareness (Aamer et al., 2021).

From the perspective of the purpose of this study it is relevant just to identify macroeconomic indicators that, when juxtaposed with changes in the number of ISO 9001 certificates in each country, will allow us to identify scientifically interesting relationships. Two articles identify specific indicators (presented in Table 3) that define a country's economic situation, against which certificate count data can be analyzed in search of useful relationships.

Table 3.
Indicators for analyzing the saturation of ISO 9001 certifications

Article	Indicators
(Marra da Silva Ribeiro et al., 2021)	Macroeconomic measures: – Gross Domestic Product (GDP) – Gross National Income (GNI) – Total exports (EXP) – Total reserves (TR) – Control of Corruption (CC) – Corruption Perception Index (CPI) – Short-term External Debt (EDS) – Foreign Direct Investment (FDI) – Human Development Index (HDI) – Global Competitiveness Index (GCI)
(Toporowicz et al., 2021)	World Bank Indicators: – Land area (sq km) – Population (total) – Labour force (total) – Gross Domestic Product (GDP) – Gross National Income (GNI) – Total import (IMP)

Source: own elaboration based on (Marra da Silva Ribeiro et al., 2021) and (Toporowicz et al., 2021).

The adoption of ISO 9001 is usually related to macroeconomic factors, and the literature indicates that it also relates to governance and sociocultural factors (Marra da Silva Ribeiro et al., 2021). With the rapid expansion of international trade, companies are progressively adopting management system standards that “dazzle” the market (Toporowicz et al., 2021).

2.3. Narrow literature results – V4 focus

Of the 112 articles analyzed, ten contain descriptions related to V4 countries.

In 2018, the first article included a description of a survey of 130 different organizations in Poland, aimed at identifying reasons for abandoning quality management system certification. That paper showed that internal factors are the most important reasons for the withdrawal "ISO 9001" like financial problems, a perceived lack of added value from certification, and internal restructuring (Simon, Kafel, 2018). The second article presented data from a survey conducted in Poland and Slovakia between SMEs, which operate in the textile industry with the general conclusion that QMS positively influences business performance (Zimon et al., 2018).

Four articles on the geographic area under study were published in 2020, after none in 2019. A description of them, in a nutshell, is included in Table 4.

Table 4.
Brief description of articles about V4 countries published in the 2020 year

Article	Industry	Country	Scope
(Zimon et al., 2020)	Textile	Poland, Slovakia, Czech Republic	Analysis of the synergy influence of ISO 9001 and ISO 14001 on sustainable supply chain management in the textile industry.
(Moczulska, Rogala, 2020)	Different	Poland	Identification of a set of competences, which should be mastered by a person responsible for a QMS ISO 9001 to fulfill tasks effectively.
(Pacana, Ulewicz, 2020)	Different SMEs	Poland	Analysis of the causes and benefits of implementing a QMS in developing and innovative regions on the example of enterprises from South-Eastern Poland.
(Zimon, Dellana, 2020)	SMEs in the heating technology service industry	Poland	Exploring the expectations for ISO 9001 certification and analyzing the decision to abandon certification.

Source: own elaboration.

Two other articles were published in the 2021 year, both placed the empirical study in Poland. The first one focused on ISO 9001 in local governments and the authors analyzed the relations between the resources that are related to organizational capacity and the implementation of the QMS (Ćwiklicki et al., 2021). The second one concentrated on the metal manufacturing company and the authors analyzed the relation between having ISO 9001 in order to maintain high product quality and customer satisfaction (Midor, Wilkowski, 2021).

In 2022 year was published another paper analyzing organizations in the textile industry in three countries (Poland, Slovakia and the Czech Republic). That study shed some light on the benefits of implementing more than one management system (Zimon et al., 2022).

In 2023 year Cződörová and Gnap (2023) published an article that showed a significant positive difference in average values of transport companies in Slovakia in the period after obtaining ISO 9001 certification when compared to the period without certification.

3. Quality management – certification aspects

Analysis of the structure and trends of ISO 9001 certificates is presented first worldwide. Secondly, particular attention was dedicated to the number of certifications in V4 countries, in alphabetical order.

3.1. World background – Visegrad perspective

Total valid ISO 9001 certificates all over the world are gradually increasing, and the values for the analyzed period 2018-2022 are highlighted in Figure 1.

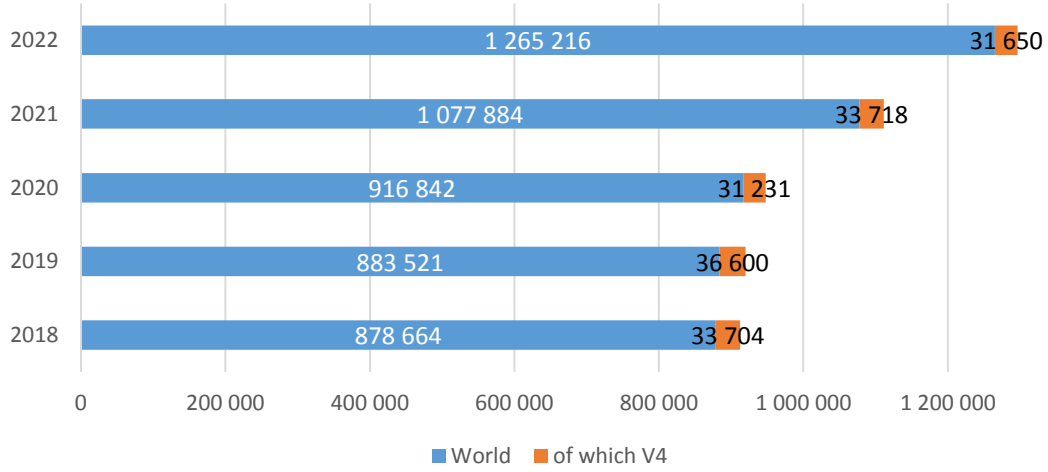

Figure 1. Numbers of ISO 9001 certificates – world vs. V4.

Source: own elaboration based on ISO Survey (2019, 2020, 2021, 2022, 2023).

While the total number of certificates worldwide is increasing year by year, the total for the V4 group of countries is variable. The share of the number of certificates in the V4 countries relative to the global total varies over the analyzed period between 4.14% (in 2019) and the lowest at the end of 2022 (2.50%). That fluctuation is visible in Figure 2.

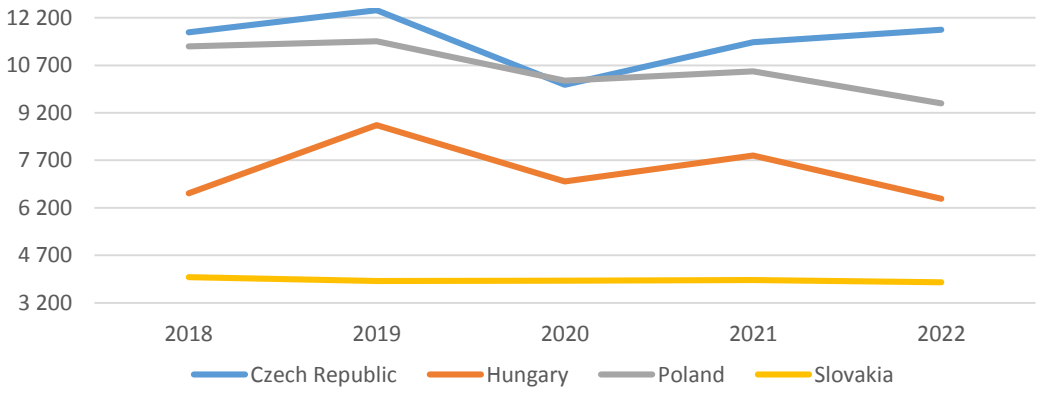

Figure 2. Trends in certificates in V4 countries.

Source: own elaboration based on ISO Survey (2019, 2020, 2021, 2022, 2023).

The data, however, converge in the industry area. The largest number of ISO 9001 certificates in the world has been issued to companies functioning in the industry of "Basic metal & fabricated metal products" (121 728 at the end of 2022). In the second place, with 107 975, is the ABC "Wholesale & retail trade, repairs of motor vehicles, motorcycles & personal & household goods" industry. The industry coverage in the four countries is similarly shaped (see Table 5).

Table 5.
ISO 9001 certificates in V4 by sectors

Country	2018	2019	2020	2021	2022
	Sector				
Czech Republic	807	1 983	1 551	1 558	1 747
	Construction		Basic metal & fabricated metal products		
Hungary	914	1 000	884	997	721
	Wholesale & retail trade, repairs of motor vehicles, motorcycles & personal & household goods				
Poland	1 363	1 664	1 643	1 637	1 459
	Basic metal & fabricated metal products				
Slovakia	731	742	771	767	755
	Wholesale & retail trade, repairs of motor vehicles, motorcycles & personal & household goods				

Source: own elaboration on the basis of basis of ISO Survey (2019, 2020, 2021, 2022, 2023).

The next step is to determine a set of metrics as criteria for making comparisons, and afterwards prepare conclusions, of the number of certificates in each country. The basis is shown in Table 3 as a result of the literature review the following indicators were adopted:

1. Gross Domestic Product (GDP), preferably in per capita version which takes into account country size by population.
2. Labour force (LAB) as the employment rate for persons in relation to population.
3. Gross National Income (GNI) also per capita – as GDP plus net receipts from abroad of compensation of employees, property income and net taxes less subsidies on production.
4. The Human Development Index (HDI) which links GNI per capita with other social measures.
5. It is underlined that the QMS certificate is important in export, so another indicator is (EXP) Exports of goods and services Total import.
6. The next measure is connected with the previous one – Total import (IMP).
7. Foreign direct investment (FDI) as indirect information about perceptions of a country's economic attractiveness.
8. Corruption Perception Index (CPI) also affects the country's attractiveness.
9. The Global Competitiveness Index (GCI), is a highly comprehensive index, which captures different foundations of national competitiveness.

The data on the above indicators for 2018-2022 were compared with the number of ISO 9001 certifications in each of the V4 countries (in alphabetical order) analyzed.

3.2. Context in Czech Republic

According to Kozel et al. (2017) the quantity of ISO 9001 standard compliance certifications has been steadily increasing on a global scale. Within Europe, including Poland and the Czech Republic, ISO 9001 stands out as the primary standard for quality management systems. These countries adopted quality management principles in 1993, directly influencing the number of certifications issued by accreditation bodies. In 2015, Poland held the 8th position in Europe in terms of certificate count, whereas the Czech Republic held the 9th spot. A detailed analysis spanning from 1993 to 2015 underscores the Czech Republic's higher level of involvement in implementing the ISO 9001 standard. Only in 2003, 2008, and 2015 did Poland exceed the Czech Republic in the issuance of ISO 9001 certificates (Kozel et al., 2017).

The change in the number of ISO 9001 certifications over the years, compared with macroeconomic data in Czech Republic, is included in Table 6. Taking 2018 as the base year, the table provides information on the percentage changes in the data year-on-year (2018 as a base), which allows relative comparability between the data.

Table 6.
Czech Republic – country's indicators versus ISO 9001 certificate numbers

No	Indicator (number year-on-year)	2018	2019	2020	2021	2022	Pearson correlation coefficient*
1.	GDP per capita (US$)	23 424.5	23 664.8 1.03%	22 992.9 -2.84%	26 822.5 16.66%	27 638.4 3.04%	- 0,66
2.	LAB (%)	84,21	84,40 0.23%	84,44 0.05%	84,90 0.54%	85.95 1.24%	- 0,84
3.	GNI per capita (US$)	38 890	41 540 6.81%	40 690 -2.05%	43 760 7.54%	47 780 9.19%	- 0,78
4.	HDI	0.894	0.897 0.34%	0.892 -0.56%	0.889 -0.34%	-	0,05
5.	EXP (% of GDP)	76.9	73.9 -3.90%	69.9 -5.41%	72.7 4.01%	74.8 2.89%	0,32
6.	IMP (% of GDP)	71	67.9 -4.37%	63.2 -6.92%	69.8 10.44%	74.9 7.31%	- 0,28
7.	FDI (% of GDP)	3.3	4.3 30.30%	3.5 -18.60%	4.6 31.43%	3.6 -21.74%	0,19
8.	CPI	59	56 -5.08%	54 -3.75%	54 0.00%	56 3.70%	0,46
9.	GCI	29	33 13.79%	33 0.00%	34 3.03%	26 -23.53%	0,44
10.	ISO 9001	11 294	11 460 1.47%	10 219 -10.83%	10 512 2.87%	9 494 -9.68%	

* refers to the first value in the cells.

Source: own elaboration based on: (1) https://data.worldbank.org; (2) https://data.oecd.org; (3) https://data.worldbank.org; (4) https://hdr.undp.org; (5) https://data.worldbank.org; (6) https://data.worldbank.org; (7) https://data.worldbank.org; (8) https://www.transparency.org; (9) https://www.imd.org; https://tradingeconomics.com; (10) www.iso.org

Analyzing the year-to-year data shows a decline in the highest number of indicators in 2020, the year of the beginning of the Covid-19 pandemic in Europe. The number of ISO 9001 certificates at the end of 2020 declined by 10% from the previous year. After a minimal upward rebound the following year, at the end of 2022 this number fell by another 10% (year-on-year).

There was a big decrease in Global Competitiveness Index (GCI) in 2022 year with a small but nevertheless increase in imports. Correlation between numbers of ISO 9001 certificates and GCI is positive moderate (0.44 – the highest positive rank in last column) and weak negative with IMP (-0.28). The highest negative correlation for number of ISO 9001 certificates is with LAB (-0.84 very strong correlation) and little less with GNI (-0.78) and GDP (-0.66).

Analyzing the data between the cut-off dates in the analyzed period 2018-2022, it is the number of ISO 9001 certifications that decreased (by 16%), while the value of Gross Domestic Product (GDP per capita) increased by 18% and Gross National Income (GNI per capita) 23%. On the other hand, Global Competitiveness Index (GCI) decreased by 10%, as well as exports (EXP) decreased by almost 3%.

Current trend in area of quality assurance and quality assessment in Czech Republic goes beyond the mere requirements of ISO 9001:2015 standard, not only in the production sphere, but also in public service. There are cases in higher education institutions (schools, faculties) where the QMS has been certified according to ISO 9001 as a base. Moreover, all activities provided by the higher education institution to stakeholders represent public service (Vykydal et al., 2020). Vykydal & Nenadál (2022) state in their research that many certified quality management systems, especially according to the requirements of ISO 9001:2015, are rigid, static and do not meet the current requirements for the new era of digitalization within the framework of today's Quality 4.0 trend. The authors are sure that Czech manufacturing companies will not be able to afford to ignore the concept of Quality 4.0, because the transformation of quality management is perhaps not only an opportunity, but also a strong requirement to adapt each company to the new industrial reality (Vykydal, Nenadál, 2022).

3.3. Context in Hungary

The change in the number of ISO 9001 certifications over the years, compared with macroeconomic data in Hungary, is included in Table 7. Taking 2018 as the base year, the table provides information on the percentage changes in the data year-on-year (2018 as a base).

Table 7.
Hungary – country's indicators versus ISO 9001 certificate numbers

No	Indicator	2018	2019	2020	2021	2022	Pearson correlation coefficient*
1.	GDP per capita (US$)	16 425.2	16 786.2 2.20%	16 125.6 - 3.94%	18 772.1 16.41%	18 463.2 - 1.65%	- 0,01
2.	LAB (%)	81.93	82.67 0.90%	83.20 0.64%	84.53 1.60%	85.95 1.68%	- 0,27

Cont. table 7.

3.	GNI per capita (US$)	30 660	33 730 10.01%	33 360 - 1.10%	35 650 6.86%	40 620 13.94%	- 0,20
4.	HDI	0.849	0.853 0.47%	0.849 - 0.47%	0.846 - 0.35%	-	0,50
5.	EXP (% of GDP)	83.8	81.5 - 2.74%	78.7 - 3.44%	80.3 2.03%	90.4 12.58%	- 0,52
6.	IMP (% of GDP)	79.5	79.2 - 0.38%	76.8 - 3.03%	79.9 4.04%	94.5 18.27%	- 0,46
7.	FDI (% of GDP)	- 40.1	60.0 249.63%	106.6 77.67%	16.4 -84.62%	- 7.8 -147.56%	0,42
8.	CPI	46	44 - 4.35%	44 0.00%	43 - 2.27%	42 - 2.33%	- 0,02
9.	GCI	48	47 - 2.08%	47 0.00%	42 - 10.64%	39 - 7.14%	0,26
10.	ISO 9001	6 658	8 815 32.40%	7 030 -20.25%	7 856 11.75%	6 482 - 17.49%	

* refers to the first value in the cells

Source: own elaboration based on: (1) https://data.worldbank.org; (2) https://data.oecd.org; (3) https://data.worldbank.org; (4) https://hdr.undp.org; (5) https://data.worldbank.org; (6) https://data.worldbank.org; (7) https://data.worldbank.org; (8) https://www.transparency.org; (9) https://www.imd.org; https://tradingeconomics.com; (10) www.iso.org

Analyzing the year-to-year data shows a decline in the highest number of indicators in 2020, the year of the beginning of the Covid-19 pandemic in Europe. The number of ISO 9001 certificates at the end of 2020 declined by 10% from the previous year. After a minimal upward rebound the following year, at the end of 2022 this number fell by another 10% (year-on-year).

There was a big decrease in Global Competitiveness Index (GCI) in 2022 year with a small but nevertheless increase in imports. Correlation between numbers of ISO 9001 certificates and GCI is positive moderate (0.44 – the highest positive rank in last column) and weak negative with IMP (-0.28). The highest negative correlation for number of ISO 9001 certificates is with LAB (-0.84 very strong correlation) and little less with GNI (-0.78) and GDP (-0.66).

Analyzing the data between the cut-off dates in the analyzed period 2018-2022, it is the number of ISO 9001 certifications that decreased (by 2.64%), while the value of Gross Domestic Product (GDP per capita) increased by 12.41% and Gross National Income (GNI per capita) 32.49%. On the other hand, Global Competitiveness Index (GCI) decreased by 18.75%, versus 18.87% increase of imports (EXP).

The period between 2018-2022 brought a lot of challenges for Hungarian organizations, including COVID-19, price and salary inflation, and raw material shortages as well. The boom and widespread dissemination of digitalization and automation became the dominant environmental trend and significant pillar of competitiveness in the whole economy. This policy-crises environment demands that organizations pay particular attention to risk management in any sector. The most remarkable focus of recent ISO 9000 and 14000 standards released in 2015, answer exactly this challenge (Berényi, 2018; Schmuck, 2021).

The recent wave of digitalization focuses on the implementation of new digital technologies in the processes and value creation on the system or organizational level. This approach requires process and system-based thinking for decision-makers to gain value within the organizations. To operationalize the process and system-based view, ISO 9000:2015 standards ensure a comprehensive and merged management framework. Schmuck's (Schmuck, 2023) research confirmed that ISO 9001-certified SME organizations could explore real benefits in digitalization compared to those, which had not. Berényi (2018) has already analyzed the correlation between the volume of ISO standards and some national macroeconomic indicators in several CEE countries such as Bulgaria, Czech Republic, Hungary, Poland, Romania, and Slovakia. The study analyzed the period from 1993 to 2015, and showed a strong linear relationship between indicators (GDP, export, export ratio, capital formation, capital formation per capita, and HDI) and the number of ISO certifications per million employees, except for employment indicator. The employment indicator in this study showed a strong negative correlation, especially in Romania (Berényi, 2018).

The analyzed five-year term in this study started a strong rise in the number of ISO certifications with a peak in 2019, but later, there was a steady decrease, except for a solid rise in 2021 again. This fluctuation in the number of ISO standards over such a short period does not show that strong linear relationship with the analyzed indicators, which can be read in the former research. The picture is mixed, FDI, HDI and GCI have positive and strong correlations with certifications, however, the variables indicate weak or strong negative relationships. Behind this fluctuation, not the impact of or reaction to COVID-19 may stand, but rather the implementation of or change for ISO 9001:2015 standard.

3.4. Context in Poland

The fluctuation in the number of ISO 9001 certifications over the years, compared with macroeconomic data in Poland, is included in Table 8. The table provides information on the percentage changes in the data year-on-year (2018 as a base).

Table 8.
Poland – country's indicators versus ISO 9001 certificate numbers

No	Indicator	2018	2019	2020	2021	2022	Pearson correlation coefficient*
1.	GDP per capita (US$)	15 504.5	15 700 1.26%	15 816.8 0.74%	17 999.8 13.80%	18 321.3 1.79%	0.09
2.	LAB (%)	76.47	76.80 0.43%	77.73 1.21%	79.99 2.91%	80.84 1.06%	- 0.05
3.	GNI per capita (US$)	30 680	33 510 9.22%	33 970 1.37%	36 340 6.98%	41 310 13.68%	0.07
4.	HDI	0.877	0.881 0.46%	0.876 - 0.57%	0.876 0.00%	-	0.77
5.	EXP (% of GDP)	52.7	53.2 0.95%	53 -0.38%	57.9 9.25%	61.7 6.56%	0.18

Cont. table 8.

6.	IMP (% of GDP)	50.7	49.5 - 2.37%	47.3 -4.44%	54.5 15.22%	60.6 11.19%	0.36
7.	FDI (% of GDP)	3.3	3 - 9.09%	3.2 6.67%	5.5 71.88%	5.1 - 7.27%	0.07
8.	CPI	60	58 - 3.33%	56 - 3.45%	56 0.00%	55 -1.79%	0.36
9.	GCI	37	38 2.70%	39 2.63%	47 20.51%	50 6.38%	0.07
10.	ISO 9001	11 740	12 439 5.95%	10 085 -18.92%	11 429 13.33%	11 822 3.44%	

* refers to the first value in the cells

Source: own elaboration based on: (1) https://data.worldbank.org; (2) https://data.oecd.org; (3) https://data.worldbank.org; (4) https://hdr.undp.org; (5) https://data.worldbank.org; (6) https://data.worldbank.org; (7) https://data.worldbank.org; (8) https://www.transparency.org; (9) https://www.imd.org; https://tradingeconomics.com; (10) www.iso.org

In 2020, there was a significant decrease in the number of certificates (18.92% less than the year before) with the other indicators essentially unchanged, where it was the initial period of the Covid-19 pandemic. In the following year, more changes are noticeable. The number of certificates increased by more than 13%, as did GDP and the largest increase (almost 72%) was recorded in the FDI indicator. The highest (and positive) correlation for ISO 900 certificates is with respect to the HDI index (0.77) and also for IMP (0.36). It is connected with external context of quality management system what is important for decision-making of implementing and also for functioning that system (Dziedzic et al., 2023).

Changes of the number of ISO 9001 QMS implemented, are noticeable. Reasons of this state of matters are strongly differentiated and (Spychalski, 2022) underlined two threats in this process of ISO 9001 dissemination: technical complications connected with fulfilling formal requirements and financial aspect (because standard is not directly focused on increasing financial performance of an organization).

Wolniak (2019) analyzed the problem of measuring the maturity of quality management systems what is connected with certification QMS ISO 9001 and also decertification as well. "The more positive the organization's management's attitude to the implementation of certified quality management systems, the higher the quality management system maturity" (Wolniak, 2019, p. 13) was one of several conclusions. Also there were indicated positive interrelations between the quality management system maturity and the size of the organization and also the market position, and the financial condition, as well.

3.5. Context in Slovakia

ISO 9001 standard requires subsequent certification of the management system in place (of the processes in place) in the organization. The result is a certificate that is internationally recognized and is a prerequisite for a certain maturity and maturity of the organization (Kollár et al., 2016). On the basis of the summarized Table 9, is noticeable that the development of the number of ISO 9001 certificates in the study period 2018-2022 has a volatile character.

In 2018 the number of certificates was 4012, but in 2019 there is a decrease of 126 certificates. Subsequently, in 2020, their number increased again by 11 certificates. From 2021 onwards, the trend was downward, with a decrease of 24 certificates in that year and 69 certificates in 2022. Between the set of indicators presented in Table 9 and the number of ISO 9001 certificates in the study years 2018-2022, we can conclude that the development of each indicator had a volatile character with a trend of gradual increase. For most of the indicators, a decrease was observed in 2020, which is related to the outbreak of the global pandemic COVID-19. However, from 2021 onwards, there is again an increase in the values for the set of indicators under study. The least significant decrease in values in 2020 was recorded in the following indicators: GDP per capita (US$), LAB (%), HDI and CPI.

Table 9.
Slovakia – country's indicators versus ISO 9001 certificate numbers

No	Indicator	2018	2019	2020	2021	2022	Pearson correlation coefficient*
1.	GDP per capita (US$)	19 486.4	19 381.6 - 0.54%	19 551.6 0.88%	21 782.9 11.41%	21 258.1 - 2.41%	- 0,33
2.	LAB (%)	79.81	80.39 0.73%	80.28 - 0.14%	83.14 3.56%	84.67 1.84%	- 0,50
3.	GNI per capita (US$)	30 880	32 650 5.73%	32 510 - 0.43%	33 490 3.01%	36 840 10.00%	- 0,80
4.	HDI	0.859	0.862 0.35%	0.857 - 0.58%	0.848 - 1.05%	-	0,02
5.	EXP (% of GDP)	95.8	91.9 - 4.07%	85.1 - 7.40%	92.4 8.58%	99.1 7.25%	0,05
6.	IMP (% of GDP)	94	91.6 - 2.55%	83.4 -8.95%	92.4 10.79%	104.8 13.42%	- 0,24
7.	FDI (% of GDP)	2.1	2.2 4.76%	- 1.1 - 150.00%	0.8 - 172.73%	3.5 337.50%	- 0,11
8.	CPI	50	50 0.00%	49 - 2.00%	52 6.12%	53 1.92%	- 0,39
9.	GCI	41	53 29.27%	57 7.55%	50 - 12.28%	49 - 2.00%	- 0,72
10.	ISO 9001	4 012	3 886 - 3.14%	3 897 0.28%	3 921 0.62%	3 852 - 1.76%	

* refers to the first value in the cells

Source: own elaboration based on: (1) https://data.worldbank.org; (2) https://data.oecd.org; (3) https://data.worldbank.org; (4) https://hdr.undp.org; (5) https://data.worldbank.org; (6) https://data.worldbank.org; (7) https://data.worldbank.org; (8) https://www.transparency.org; (9) https://www.imd.org; https://tradingeconomics.com; (10) www.iso.org

The implementation of the quality management system according to ISO 9001 is a strategic decision for an organization that can help to improve its overall performance and provide a sound basic for sustainable development (Knop, 2021). Karhalíková (2016) indicated that implementation of management systems has mainly marketing's motives, and thus they are more intensively concerned with their appearance, behavior and public presentation in order to differentiate themselves from competitors. Vanova et al. (2017) conducted research on a sample of 125 companies in Slovakia. That research found that effective communication between

senior managers and employees and also with key stakeholders is essential in functioning QMS. Cződörová and Gnap (2023) investigated the impact of introducing an ISO 9001 quality management system on the performance of 17 transport companies in Slovakia. The first significant finding was that the selected studied indicators such as return on assets, return on sales, size of the transport company and age of the transport company in the selected transport companies showed a significant positive difference in their mean values in the year of the period after obtaining ISO 9001 certification compared to the period without certification. Further investigation of the financial situation of the transport companies that already had an ISO 9001 quality management system in place revealed that all the values of the selected indicators became positive in 2020 during the COVID-19 pandemic, which may have been due to the fact that the transport companies retained their customers. Innovation in the manufacturing sector must be introduced to meet the demands of industrial production in the competitive era of Industry 4.0 and to increase the competitiveness and performance of the companies. As there is more competition among companies in the Industry 4.0 era, many are forced to innovate to improve the productivity and profitability of their organization (Richnák, 2022).

3.6. The Visegrad Group

Relationships between the number of ISO 9001 certificates and individual macroeconomic indicators are not unidirectional and unified for the analyzed countries in the V4 group. That fluctuation is visible in Figure 3.

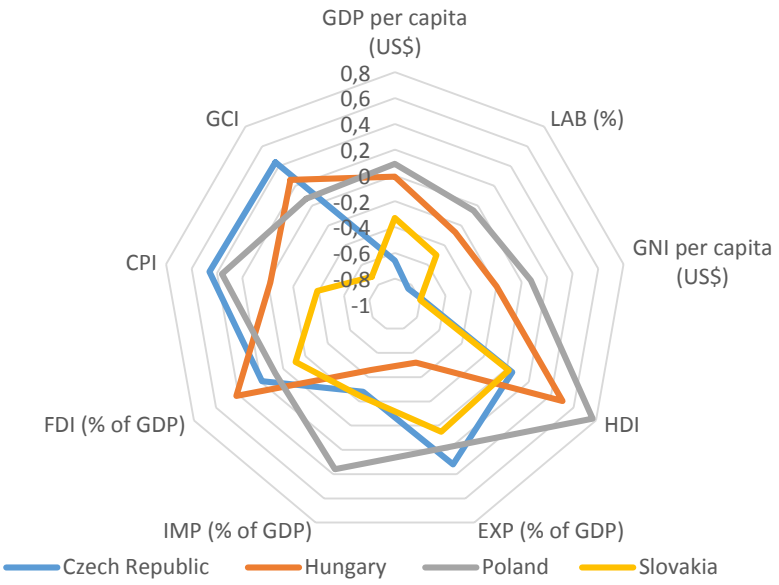

Figure 3. ISO 9001 and macroeconomic indicators – correlations according to Pearson coefficient.
Source: own elaboration based on Tables 6-9.

Comparing the Pearson maximum positive and negative index values for each country, the data in the table 10 can be pointed out.

Table 10.
Pearson correlation coefficient – maximum and minimum value for every country

Minimum value Indicator	Country	Maximum value Indicator
-0,84 LAB (%)	Czech Republic	0,46 CPI
-0,52 EXP (% of GDP)	Hungary	0,5 HDI
-0,05 LAB (%)	Poland	0,77 HDI
-0,8 GNI per capita (US$)	Slovakia	0,05 EXP (% of GDP)

Source: own elaboration based on Tables 6-9.

There is a twofold (Czech Republic and Poland) negative relationship for the LAB index. This means that the decline in the number of certificates is accompanied by an increase in the employment rate for persons in relation to population, and also conversely. In positive relationships, there is also variation in the same direction twice (for Poland and Hungary) in the number of ISO 9001 certifications vs. HDI (Human Development Index).

These relationships and the detailed data presented in this article do not allow to give a clear answer to the question indicated as the main purpose of the study: What and when influences on market saturation with a formal approach to quality management (ISO 9001 certificates)?

With regard to the "when" aspect, in the analyzed period it is noticeable data declines in 2020, followed by a rebound, which is unilaterally linked to the period of the Covid-19 pandemic. With regard to the "what" aspect, it should be noted that there are no clear trends in the analyzed data, and also between countries of V4. At the same time, when analyzing the data on the number of certificates, it is necessary to take into account the postponement over time. Time passes from the decision to implement a QMS to its certification. At the same time, QMS certification is granted by a certification body for three years, and the decision to decertify also results after a certain period of time, as well as the data in the ISO Survey pre-reports the state a few months before their publication.

4. Conclusions

The study attempts to determine the role of the ISO 9001 quality management system in economic development. The paper aimed to investigate the relationship between the number of ISO 9001 certificates and key macroeconomic indicators. The analysis covered the situation in four countries (Czech Republic, Hungary, Poland and Slovakia) in 2018-2022. The key findings are that:

1. ISO 9001 quality management system is a crucial quality management method. This is evidenced by the constantly increasing number of ISO 9001 certificates.
2. While the number of certificates is increasing globally, this trend is unclear in the Visegrad Group countries. During the period covered by the analysis, this number sometimes increased and sometimes decreased.
3. It is impossible to indicate a clear relationship between the number of ISO 9001 certificates and any of the nine macroeconomic indicators for Visegrad Group. However, in the case of some countries, such a relationship was observed (but it is not universal, i.e. it does not apply to all V4 countries). It seems that the causal relationship between macroeconomic factors and the number of ISO 9001 certifications is bottom-up rather than top-down. A top-down relationship would imply an influence of macroeconomics on the number of certificates. However, it seems that the implementation of the ISO 9001 QMS is an individual issue, and their sum forms a macro level, with no global relationship between the data. This finding contradicts the results of several previous studies, which showed a correlation between the number of ISO 9001 certificates and the country's macroeconomic situation. The existence of such a correlation could have been confounded by disturbances such as the pandemic crisis and the war in Ukraine.

The content and conclusions in this article are subject to the limitations of focusing on publications issued during a given period, while concentrating on V4 countries. Therefore, further research is needed covering a larger number of countries and taking into consideration the longer period. The results may find application in subsequent research in management and quality sciences.

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Appendix

Table 11.
Journals with "9001" in the article title in Scopus database – published in 2018

No.	Journal title	Item identification
1.	Sustainability	10.3390/su10124569
2.	Production Engineering Archives	10.30657/pea.2018.21.02
3.	International Journal of Quality & Reliability Management	10.1108/IJQRM-12-2016-0217
4.	Jurnal Cakrawala Pendidikan	10.21831/cp.v38i3.16486
5.	Total Quality Management	10.1080/14783363.2016.1253466
6.	Total Quality Management	10.1080/14783363.2018.1487216
7.	Journal of Industrial Engineering and Management	10.3926/jiem.2412
8.	The TQM Journal	10.1108/TQM-12-2017-0173
9.	International Journal of Production Economics	10.1016/j.ijpe.2018.05.005
10.	Total Quality Management	10.1080/14783363.2016.1164012
11.	Innovar: Revista de Ciencias Administrativas y Sociales	10.15446/innovar.v28n70.74449
12.	Cuadernos de Gestión	105295/cdg.140507cd
13.	South African Journal of Industrial Engineering	10.7166/29-2-1741
14.	AUTEX Research Journal	10.1515/aut-2018-0020
15.	European Research on Management and Business Economics	10.1016/j.iedeen.2017.02.002
16.	International Journal for Quality Research	10.18421/IJQR12.03-07
17.	International Journal of Automotive and Mechanical Engineering	10.15282/ijame.15.3.2018.17.0432
18.	International Journal of Productivity and Performance Management	10.1108/IJPPM-05-2015-0080

Source: own elaboration.

Table 12.
Journals with "9001" in the article title in Scopus database – published in 2019

No.	Journal title	Item identification
1.	Total Quality Management	10.1080/14783363.2019.1665867
2.	Studies in Educational Evaluation	10.1016/j.stueduc.2019.03.013
3.	Quality Assurance in Education	10.1108/QAE-09-2018-0103
4.	SAGE Open	10.1177/2158244019870773
5.	International Journal of Quality and Service Sciences	10.1108/IJQSS-06-2018-0057
6.	Production Planning & Control	10.1080/09537287.2019.1566840
7.	Quality - Access to Success	https://eds.s.ebscohost.com/eds/pdfviewer/pdfviewer?vid=1&sid=3881223b-65de-46aa-a7e2-3a5d8f3cc2a3%40redis
8.	International Journal of Quality & Reliability Management	10.1108/IJQRM-09-2017-0174
9.	The TQM Journal	10.1108/TQM-07-2017-0072
10.	Business Horizons	10.1016/j.bushor.2018.08.008
11.	Journal of Information Systems Engineering & Management	10.29333/jisem/5890
12.	International Journal for Quality Research	10.24874/IJQR13.04-20
13.	International Journal of African Higher Education	10.6017/ijahe.v6i1.10671

Source: own elaboration.

Table 13.
Journals with "9001" in the article title in Scopus database – published in 2020

No.	Journal title	Item identification
1.	Total Quality Management & Business Excellence	10.1080/14783363.2018.1490640
2.	Industrial Management & Data Systems	10.1108/IMDS-01-2020-0038
3.	International Journal of Innovation Science	10.1108/IJIS-10-2019-0095
4.	Systematic Reviews in Pharmacy	http://repository.uinbanten.ac.id/id/eprint/5802
5.	Quality - Access to Success	https://eds.s.ebscohost.com/eds/pdfviewer/pdfviewer?vid=1&sid=ce5cdba1-2b44-4220-97d3-8bdf34c10720%40redis
6.	Journal of Scientific & Industrial Research	http://op.niscpr.res.in/index.php/JSIR/article/view/41722/465478088
7.	The TQM Journal	10.1108/TQM-05-2019-0147
8.	Sustainability	10.3390/su12104282
9.	European Journal of Operational Research	10.1016/j.ejor.2019.11.042
10.	International Journal of Quality & Reliability Management	10.1108/IJQRM-06-2018-0154
11.	Dyna	10.15446/dyna.v87n213.83230
12.	Total Quality Management	10.1080/14783363.2017.1404428
13.	International Journal of Quality & Reliability Management	10.1108/IJQRM-10-2018-0281
14.	International Journal of Quality & Reliability Management	10.1108/IJQRM-02-2019-0048
15.	International Journal of Quality & Reliability Management	10.1108/IJQRM-07-2018-0171
16.	Gestão & Produção	10.1590/0104-530X4715-20
17.	Gestão & Produção	10.1590/0104-530X4043-20
18.	IEEE Access	10.1109/ACCESS.2020.2998434
19.	International Journal for Quality Research	10.24874/IJQR14.03-18
20.	IEEE Access	10.1109/ACCESS.2020.3029744
21.	Management Science Letters	10.5267/j.msl.2020.6.039
22.	Polish Journal of Management Studies	10.17512/pjms.2020.21.1.21
23.	Systematic Reviews in Pharmacy	10.31838/srp.2020.10.134
24.	The TQM Journal	10.1108/TQM-02-2019-0053
25.	The TQM Journal	10.1108/TQM-05-2019-0141
26.	International Journal of Quality & Reliability Management	10.1108/IJQRM-10-2018-0284

Source: own elaboration.

Table 14.
Journals with "9001" in the article title in Scopus database – published in 2021

No.	Journal title	Item identification
1.	The TQM Journal	10.1108/TQM-04-2020-0071
2.	Production Engineering Archives	10.30657/pea.2021.27.29
3.	The American Journal of Surgery	10.1016/j.amjsurg.2020.11.014
4.	International Journal of Production Economics	10.1016/j.ijpe.2020.108024
5.	The TQM Journal	10.1108/TQM-04-2020-0068
6.	Computer Standards & Interface	10.1016/j.csi.2020.103453
7.	Construction Management and Economics	10.1080/01446193.2021.1983186
8.	The TQM Journal	10.1108/TQM-03-2020-0055
9.	FME Transactions	10.5937/FME2104835F
10.	International Journal for Quality Research	10.24874/IJQR15.03-14
11.	Measuring Business Excellence	10.1108/MBE-07-2020-0100
12.	South African Journal of Industrial Engineering	10.7166/32-2-2415
13.	Total Quality Management & Business Excellence	10.1080/14783363.2019.1625266
14.	Total Quality Management & Business Excellence	10.1080/14783363.2019.1677151
15.	Total Quality Management & Business Excellence	10.1080/14783363.2019.1696672
16.	Total Quality Management & Business Excellence	10.1080/14783363.2020.1717332
17.	Total Quality Management & Business Excellence	10.1080/14783363.2020.1756246
18.	Total Quality Management & Business Excellence	10.1080/14783363.2020.1768062

19.	The TQM Journal	10.1108/TQM-03-2019-0076
20.	Journal of Environmental Planning and Management	10.1080/09640568.2020.1817729
21.	Public Organization Review	10.1007/s11115-020-00485-2
22.	Total Quality Management & Business Excellence	10.1080/14783363.2020.1724508

Source: own elaboration.

Table 15.
Journals with "9001" in the article title in Scopus database – published in 2022

No.	Journal title	Item identification
1.	The TQM Journal	DOI 10.1108/TQM-09-2021-0263
2.	The TQM Journal	10.1108/TQM-08-2020-0177
3.	International Journal of Social Ecology and Sustainable Development	10.4018/IJSESD.292037
4.	Journal of the Knowledge Economy	10.1007/s13132-021-00805-x
5.	Corporate Social Responsibility and Environmental Management	10.1002/csr.2214
6.	The TQM Journal	DOI 10.1108/TQM-01-2021-0025
7.	International Journal of Quality and Service Sciences	10.1108/IJQSS-02-2021-0031
8.	International Journal of Lean Six Sigma	10.1108/IJLSS-10-2020-0164
9.	International Journal of Quality & Reliability Management	10.1108/IJQRM-04-2020-0127
10.	Fibres and Textiles in Eastern Europe	10.2478/ftee-2022-0003
11.	International Journal for Quality Research	10.24874/IJQR16.02-07
12.	*International Journal of eBusiness and eGovernment Studies*	10.34109/ijebeg.202214121
13.	South African Journal of Industrial Engineering	10.7166/33-1-2521
14.	Total Quality Management & Business Excellence	10.1080/14783363.2020.1829969
15.	Total Quality Management & Business Excellence	10.1080/14783363.2021.1944083
16.	Total Quality Management & Business Excellence	10.1080/14783363.2021.1997142

Source: own elaboration.

Table 16.
Journals with "9001" in the article title in Scopus database – published in 2023

No.	Journal title	Item identification
1.	Accreditation and Quality Assurance	10.1007/s00769-023-01543-0
2.	Engineering, Construction and Architectural Management	10.1108/ECAM-07-2021-0656
3.	Cogent Business & Management	10.1080/23311975.2023.2203304
4.	Food Policy	10.1016/j.foodpol.2023.102455
5.	Sustainability	10.3390/su15032401
6.	Benchmarking: An International Journal	10.1108/BIJ-06-2022-0355
7.	International Journal of Productivity and Performance Management	10.1108/IJPPM-05-2023-0224
8.	International Journal of Productivity and Performance Management	10.1108/IJPPM-08-2022-0398
9.	International Journal of Organizational Analysis	10.1108/IJOA-05-2021-2753
10.	International Journal of Productivity and Performance Management	10.1108/IJPPM-07-2022-0345
11.	International Journal of Productivity and Performance Management	10.1108/IJPPM-12-2021-0716
12.	International Journal of Quality & Reliability Management	10.1108/IJQRM-08-2022-0233
13.	Production Planning & Control	10.1080/09537287.2021.1916638
14.	Quality Innovation Prosperity	10.12776/QIP.V27I1.1808
15.	Statistics in Transition	10.59170/stattrans-2023-026
16.	Total Quality Management & Business Excellence	10.1080/14783363.2023.2192916
17.	Total Quality Management & Business Excellence	10.1080/14783363.2023.2203379

Source: own elaboration.